

PH.D. IN PHYSICS

Program Overview

All graduate students in physics must plan their entire program with the advice and approval of a departmental advisor.

The program of graduate studies in physics emphasizes research work, but also includes teaching experience as an essential element. Research and thesis opportunities are at present available in the fields of astrophysics and cosmology, atmospheric, ocean and quantum optics, biological physics, complexity, condensed matter/energy materials physics, elementary particle theory.

Admission Requirements

Consideration is given to applicants who have a B.S. degree in physics (or related field) with a minimum undergraduate GPA of B. Submission of Graduate Record Examination (general and subject GRE) scores is recommended, but not required, with the application for admission. Applicants from non-English-speaking countries must demonstrate proficiency in English via the TOEFL or IELTS test, even if they have previously taken courses in the US. The minimum TOEFL score for admission is 80 in the internet-based test, or equivalent (550 in the paper-based test and 213 in the computer-based one). The minimum IELTS score is 6.5.

Application deadline for the Fall Semester is February 1st. Application for financial aid is automatic and does not require any additional document on the part of the applicant. The only accepted form of application is online through the Graduate School web page (<https://www.grad.miami.edu/apply/on-campus-graduate-programs/>). In addition to excellence in the academic background, consideration for admission is also based on diversity and interest in one of the research fields of the Department. While not bound to it, please indicate in your application your field of interest and whether you are interested in experimental or theoretical work.

We usually do not offer Spring admission and all applications will be considered for fall admission, regardless of the time of submission. In rare circumstances, an exception can be made, and the applicant should contact us at the address reported below to request it before applying.

Curriculum Requirements

In addition to the general requirements for graduate degrees, the Physics Department makes the following specific requirements.

1. A minimum of 24 physics course credit hours at the 600-700 level are required for the PhD.
2. The following specific courses, or their equivalent, are required for the PhD degree:

Code	Title	Credit Hours
Required Courses		
PHY 640	Classical Mechanics II	3
PHY 660	Quantum Mechanics and Modern Physics I	3
PHY 661	Quantum Mechanics and Modern Physics II	3
PHY 723	Statistical Mechanics I	3
PHY 752	Electromagnetic Theory I	3
PHY 753	Electromagnetic Theory II	3
PHY 770	Quantum Theory I	3
PHY 771	Quantum Theory II	3
Select three additional physics lecture courses at the 600 or 700 level		9
Additional Courses		
PHY 780	Directed Readings or Research	3
PHY 840	Post-Candidacy Doctoral Dissertation	24
Total Credit Hours		60

3. Courses taken outside the department should be relevant to the students' program and approved by the graduate advisor.
4. Students are required to participate in research at the earliest opportunity. Mechanisms for doing so include enrolling during the regular semester in a research course (phy 780) and engaging in research during the summer months; both require the consent of a faculty member supervisor.
5. The comprehensive exams for Ph.D students in physics consist of the **Written Qualifying Exam**, an **Oral Presentation** and an accompanying **Expository Paper**. The **Written Exam**, offered each year in January, consists of sections on Classical Mechanics, Quantum Mechanics, Electromagnetism and Statistical/Thermal physics, at the advanced undergraduate level. Students have two opportunities to pass the **Written Exam** at the Ph.D level. Copies of prior exams are available in the department office.

The **Oral Presentation** and accompanying **Expository Paper** *must be completed by the end of a student's 5th semester*. In order to complete these parts of the comprehensive examinations, a student must be engaged in research with a faculty member. The purpose of the oral presentation and paper are to demonstrate preliminary research on a problem of the relevant discipline. *The presentation/paper need not constitute a proposal for*

Ph.D dissertation research or include preliminary work toward the dissertation. Students are expected to consult with and receive approval from their research mentor as to a suitable topic.

Expository Paper: 5-10pp, 11pt or 12pt typeface

The paper should include a substantive literature survey (with referencing in standard publication format) that places the topic in context, provides relevant equations, and outlines calculations or experimental design/results as appropriate. Figures (if any) should be incorporated into the text using, e.g., LaTeX or MS Word. Students (and mentors) should be wary to allow sufficient time to research, write, and edit their papers to meet the standards of a scientific publication.

Oral Presentation: 30-40 min. (not including questions)

This is typically a PowerPoint-type presentation summarizing the topic of the paper. The presentation should include technical detail as necessary to outline the topic and should be at the level of a departmental colloquium, accessible to a general audience of advanced undergraduate and graduate students.

Deadlines and Procedures:

It is the student's responsibility, in consultation with their research mentor and the graduate program advisor, to establish a **Comprehensive Exam Committee** consisting of the mentor and at least two other physics faculty, and the date for the **Oral Presentation**. The committee should receive the **Expository Paper** for review a **minimum of 10 days in advance** of the date established for the **Oral Presentation**. With the addition of a committee member from outside the physics department, the **Comprehensive Exam Committee** may constitute the student's **Ph.D Dissertation Committee**.

6. Should a student need to select a new thesis advisor, this selection must be made without delay.
7. Renewal of financial support from the department is contingent, each semester, upon satisfactory performance of teaching duties and research activities, and upon timely progress towards completion of all requirements for the Ph.D. degree.

Sample Plan of Study

Year One		Credit Hours
Fall		
PHY 640	Classical Mechanics II	3
PHY 660	Quantum Mechanics and Modern Physics I	3
PHY 752	Electromagnetic Theory I	3
Credit Hours		9
Spring		
PHY 645	Introduction to Astrophysics	3
PHY 661	Quantum Mechanics and Modern Physics II	3
PHY 753	Electromagnetic Theory II	3
Physics 600-700 Level Elective		3
Credit Hours		12
Year Two		
Fall		
Physics 600-700 Level Elective		3
PHY 613	Mathematical Techniques in Physics	3
PHY 770	Quantum Theory I	3
Credit Hours		9
Spring		
PHY 723	Statistical Mechanics I	3
PHY 771	Quantum Theory II	3
PHY 780	Directed Readings or Research	3
Credit Hours		9
Year Three		
PHY 840	Post-Candidacy Doctoral Dissertation	6
Credit Hours		6
Fourth and Fifth Years		
PHY 616	Special Topics in Physics	3

PHY 840	Post-Candidacy Doctoral Dissertation	12
	Credit Hours	15
	Total Credit Hours	60

Mission

The mission of the Physics Ph.D program is to develop productive and creative research scientists and educators by providing students with a rigorous grounding in classical and modern theory, practice in advanced experimental techniques, training in a specialized field of research, and teaching experience.

Goals

It is expected that graduates will be capable of conducting independent research, solving complex problems, communicating scientific results in both written and spoken form, and critically assessing the scientific literature.

Student Learning Outcomes

- Students will demonstrate a rigorous grounding in classical and modern physics theory, the associated mathematical methods and their applications.
- Students will demonstrate their ability to conduct independent research, incorporating the ability to critically analyze and address a fundamental problem in their chosen field.
- Students will demonstrate the ability to communicate research findings effectively